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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/642,615	08/19/2003	Ali Afzali-Ardakani	YOR920030023USI	3761

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EXAMINER
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GAKH, YELENA G

ART UNIT	PAPER NUMBER
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1743

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	01/18/2007	PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/642,615	<b>Applicant(s)</b> AFZALI-ARDAKANI ET AL.	
	<b>Examiner</b> Yelena G. Gakh, Ph.D.	<b>Art Unit</b> 1743	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 1-30.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 20-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

### **DETAILED ACTION**

1. Amendment filed on 12/07/06 is acknowledged. Claims 1-30 are pending in the application. Claims 20-30 are withdrawn from consideration and were supposed to be properly marked as withdrawn. The examiner would like to warn that the submission of these claims as originally filed in response to the present Office action will yield a Notice of Non-Compliant Amendment.

Claims 1-19 are considered on merits.

#### ***Response to Amendment***

2. In response to the minor amendment the examiner sustains objection to the specification and rejections to the claims.

#### ***Specification***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The specification is objected to as being a description of the Applicants' hypothesis for a possible molecular manipulator based on known facts from the area of nanotechnology related to molecular tools. It does not appear that any of the proposed molecules has been synthesized and tested as claimed. The molecules depicted on Figures 1 and 2 are not CA registered (the library search report is attached) and obviously do not exist. The Applicants did not provide any possible synthetic path for obtaining such molecules, not mentioning their testing as molecular manipulators. The hypothesis is not experimentally proven.

#### ***Claim Rejections - 35 USC § 112***

4. The following is a quotation of the first paragraph of 35 U.S.C. 112:

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The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

5. Claims 1-19 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

### *The Breath of the Claims*

The claims recite in the most general terms “a molecule manipulator” comprising a light-sensitive molecule with a double bond, in particular azo-bond, which changes its configuration upon light irradiation, with the molecule attached to the probe of a scanned-proximity probe microscope. No specifically synthesized molecules, which can act as molecular manipulators as recited in the claims, are disclosed in the specification. Two examples depicted on the pictures are not the real molecules. The specification does not provide any evidence for their synthesis or parameters.

### *The Nature of the Invention*

The invention is directed toward a hypothetical molecular manipulator based on a known fact of cis-trans light-induced transformation of azo-bond. The hypothetical molecules are attached to the tip of the atomic force microscope (AFM). Two molecules are depicted on Figures 1-2 as the examples. The molecules are not known in the literature and do not have CA registration numbers (the library search report is attached). They are not described in the specification as the known molecules; however, their synthesis is not provided either. It appears that the invention is totally hypothetical.

### *The State of the Prior Art*

The prior art is in the field of nanotechnology related to “molecular machines” or “molecular tools”. The examiner searched patent and non-patent literature pertinent to molecular tweezers, clips, manipulators, motors, etc. One of the most recent papers on molecular motors,

“Molecular Motor Spins On Surface” by Netherlands chemists was proclaimed as the “first light-driven molecular rotary motor attached to a solid surface” (Chemical & Engineering News, 2005). Klärner et al. (Acc. Chem. Res., 2003) provide a detailed review of “Molecular Tweezers and Clips as Synthetic Receptors” with tweezers and clips containing naphthalene and benzene spacer units, which are synthesized by repetitive Diels-Alder reactions. The tweezers and clips should possess specific structural, thermodynamics and other physical-chemical requirements in order for such host-guest interaction to take place. Feringa et al. (Appl. Phys., 2002) describe “Light-driven molecular switches and motors” with detailed disclosing of physical-chemical properties of molecular motors comprising double bond, which undergoes light-induced cis-trans transformation. Specific requirements should be fulfilled for the switches and motors to perform their functions. Jones et al. and Pearson et al. (J. Org. Chem., 1997) described in detail “Molecular scale wires with alligator clips” providing their full synthesis and physical-chemical characteristics. A series of papers is devoted to molecular devices based on light-induced cis-trans transformation of azo-bond in azobenzene moieties. Stiller et al. (Surface and Interface Analysis, 2000) teach “scanning Kelvin microscopy as a tool for visualization if optically induced molecular switching in azobenzene self assembling films”; Hugel et al. (Science, 2002) disclose “single-molecule optomechanical cycle” with a detailed study of molecular devices based on photosensitive azobenzene polymers. Muraoka et al. (J. Am. Chem. Soc., 2003) describe “light-driven open-close motion of chiral molecular scissors” based on azobenzene expansion and contraction (cis-trans transformation) of N=N bond. Jousseime et al. (J. Am. Chem. Soc., 2003) teach “photomechanical actuation and manipulation of the electronic properties of linear  $\pi$ -conjugated systems” using azobenzene chromophore. Wen et al. (J. Phys. Chem. B, 2005) teach “photochemical-controlled switching based on azobenzene monolayer modified silicon (III) surface”. Bellini et al. (J. Phys.:Condens. Matter, 2006) disclose “light-induced molecular motion of azobenzene-containing molecules: a random-walk model”. None of the recited papers indicate the possibility of using molecules recited in the claims and those depicted on Figures 1 and 2 as molecular manipulators; the examiner did not find any reference, which would disclose a synthesis of similar compounds. Moreover, the bulkiness of the cis-conformer of a hypothetical structure 1A would assume its high non-planarity, which may totally prevent its ability to grab molecules and be used as a molecular manipulator.

***The Level of One of Ordinary Skill***

Synthesis of any of the hypothetical structures disclosed in the specification, including those depicted on Figures 1 and 2 and recited in the claims, are beyond the skill of a routineer in the art. Even in the case of successful synthesis of such structures after a rigorous experimentation, it is outside the scope of any routineer in the art to study these molecules in relation to their ability to be molecular manipulators, as demonstrated by highly complex and detailed studies of molecular tools disclosed in the prior art.

***The Level of Predictability in the Art***

The prior art does not provide any ground for expecting success in synthesis of structures disclosed in the specification and their application as molecular manipulators.

***The Amount of Direction Provided by the Inventor***

The instant disclosure does not provide any direction as to how to synthesize at least some analogous of the compounds claimed to be molecular manipulators. Nor does it disclose any ways for determining if the synthesized molecules are capable of being molecular manipulators.

***The Existence of Working Examples***

No working examples are provided by the specification, not mentioning description of the synthesis of novel compounds.

***The Quantity of Experimentation Needed***

***to Make or Use the Invention Based on the Content of the Disclosure***

It requires an undue experimentation to synthesize hypothetical compounds disclosed in the specification and study them as potential molecular manipulators.

6. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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7. Claims 1-19 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1 recites “a probe” to which the light-sensitive molecule is attached”. “A probe” is not a definite term of the art. It can be a chemical probe (for a target molecule). It can be a physical surface. The term “probe” renders the claim unclear and indefinite.

In claim 2 it is not quite clear, what is “a line” of a scanned-proximity probe microscope, and how can the light-sensitive molecule be attached to the line?

In claims 4 and 9 the examiner suggests changing the words “comprises” to “is” and “compound” to “molecule”, since “a molecule” cannot comprise “a compound”, and “a molecule” is “a molecule”.

In claim 5 it is not apparent as what is “a moiety located between the two arms”? Is this the central part of the molecule between two arms? Since the molecule is supposed to work as molecular tweezers, the claim can be interpreted as reciting the light-sensitive molecule holding the chemical moiety between its arms.

From claim 6 it is not apparent, if “other than an azo double bond” is a double bond “other than an azo double bond”, or it is not a double bond at all.

In claim 10 “*a* same” should be changed to “*the* same”.

It is further not apparent as to what is an azo double bond “comprising *a* same cis-trans configuration, when illuminated by the light of the selected wavelength”? This phrase does not make much sense. First, it is not clear as to how the double bond can possess (comprise) cis-trans configuration? It can possess either cis-, or trans-configuration. Also, it is not apparent as to why possessing cis-trans configuration depends on illuminating the double bond by the light? Double bonds always possess either cis- or trans-configuration, independent on any illumination with the light. If the claim was supposed to recite simultaneous *changes* in cis- or trans-configuration in both arms upon illuminating by the light, then this should be clearly recite in the claim.

In claims 12, 14 and 16 the correct recitation for the Markush group is: “wherein the functional group is selected from the group consisting of ...”. Corresponding correction is required.

In claim 18 the examiner suggests changing the language to “wherein the two arms are of a different length”.

Claim 19 recites a space, which is varied depending on R. Since R is variable, the space will vary inherently. Therefore, it is not apparent, as to what structural limitation is recited in the claim. a method step.

### *Response to Arguments*

8. Applicant's arguments filed 12/07/06 have been fully considered but they are not persuasive. Nevertheless, the examiner would like to thank the Applicants for providing the proper terminology for the examiner's rejection regarding the amount of the experimentation. In the present Office action the examiner uses the proper term, “undue experimentation”, in agreement with the Applicants' remark.

The Applicants do not seem to provide any evidence, which would form a basis for their argumentation regarding the essence of the invention. It appears that the examiner was quite thorough in explaining why the instant theoretical invention did not seem to be enabled. The examiner used a plethora of references taken directly from the field of the invention, with clear explanation as to why the present hypothesis is not enabled. The Applicants' arguments that the invention is directed to the molecule manipulator, rather than the light-sensitive molecule, are quite puzzling, since the specific molecule, possessing very specific properties, is the most essential part of the manipulator. If the Applicants want to indicate that any azo compound can be used for the manipulator, the examiner respectfully requests the Applicants to demonstrate, how any of the available azo-compounds can be used in the recited molecular manipulator. The examiner clearly demonstrated that molecular manipulators are the compounds with very specific physical-chemical and structural characteristics. If the Applicants claim any compound capable of cis-trans-transformation under light as a part of the molecular manipulator system, the Applicants need to rewrite their specification according to this definition and explain, what they mean by the term “molecular manipulator”.



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Regarding the terms: describing “the probe” in specification as “*for example*, a probe of a scanned-proximity probe microscope” is not considered to be a clear and definite description of the term.

While claim 3 does not make much sense, the examiner withdraws its rejection taking into account more important problems with the claims and the whole disclosure.

The examiner could not include any prior art rejection to the un-enabled invention.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yelena G. Gakh, Ph.D. whose telephone number is (571) 272-1257. The examiner can normally be reached on 9:30 am - 6:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Jill A. Warden can be reached on (571) 272-1267. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



**YELENA GAKH  
PRIMARY EXAMINER**

1/11/07